



# Water in the West: Challenge for the Next Century

---

*June 1998*

Report of the  
Western Water  
Policy Review  
Advisory Commission

## ***FOREWORD***

I am pleased to transmit the final report of the Western Water Policy Review Advisory Commission. We were fortunate in having a dedicated staff, whose names are listed here, who carried this process through on a tight schedule. The work of this Commission also demanded much from the citizen commission members and the Congressional and agency staff members. Thanks are due to the commission members who devoted themselves to serving our government by attending meetings and reviewing reams of reports and drafts. Additionally, we deeply appreciate the contributions made to the Commission report by writers and researchers. The members of the public who took time to attend meetings, prepare testimony, and review drafts have enriched this report and have also shown that the West is capable of robust, yet respectful dialogue. This dialogue, which we hope our report will further, is where the future will be shaped.

This report provides a good overview of the status of the West's water and of the pressures that require change in our water management practices. Foremost is that the West is a magnet for population growth; a transformative fact that has affected every aspect of western life. Water policies have already begun to change in response to growth and the changing economy, but more needs to be done. We need to consider how to keep agriculture productive, while acknowledging that healthy riparian and aquatic ecosystems are also critical to the long term sustainability of the West. Growing cities need water, but water marketing makes many westerners uneasy. Tribal water needs often have been neglected, despite the legal and moral obligations that underpin them. Critics deride the federal government as having too many agencies dealing with water issues and charge that disorganization and poor coordination has resulted.

No single solution was identified in this report for these complex challenges, but our central recommendation is that the federal government must support watershed and basin innovation. Watershed and basin management are part of a shift towards stakeholder involvement and coordination of agencies, along hydrologic rather than political lines. This shift will take different forms across the West but will ease the difficulties caused by a proliferation of federal agencies and help the West address the many legitimate interests in water management. This is not a recipe for the creation of federal commissions in each basin; rather, it endorses the integration of federal programs at the watershed and basin level. Federal policies also must change in how we address tribal rights, aquatic ecosystem degradation, land use, protection of farming and ranching communities, and other critical areas. These recommendations are explicitly made within a framework of respecting existing property rights in water.

The Commission was charged with a comprehensive review of Federal activities in the western states which affect the use and allocation of water, and the review of numerous aspects of water resources, management, institutional and legal matters, and the performance of federal agencies. We did so through meetings with the public, research, and symposia, and the assistance of experts. I am especially proud of the research reports prepared for the Commission in which experts provided their appraisals of difficult water-related problems. Their research is now published and available. The basin studies that were prepared for the Commission present an incisive overview of how all of the elements listed in the statute play out in a basin and attempt to capture the interrelationship of these factors. They are not dry policy studies but are firmly anchored in the realities of particular places.

Everyone associated with western water knows how controversial it can be, with John Wesley Powell warning, "I tell you, gentlemen, you are piling up a heritage of conflict." We structured the activities of the Commission to give every opportunity for members to shape the workplan we followed, to suggest areas of study, to participate in the drafting of principles and recommendations, and to review, comment on, propose changes to, and ultimately adopt or reject the final report. With this, we transmit a report that we hope will both educate and stimulate policy ideas.

Professor Denise D. Fort  
University of New Mexico  
School of Law

## *Commission Membership*

Denise D. Fort, Chair  
Albuquerque, New Mexico

### **Citizen Appointees**

Huali Chai  
San Jose, California

Patrick O'Toole  
Savery, Wyoming

John H. Davidson  
Vermillion, South Dakota

Jack Robertson  
Portland, Oregon

John Echohawk  
Boulder, Colorado

Kenneth L. Salazar  
Denver, Colorado  
November 1995 -  
July 1997

Janet Neuman  
Portland, Oregon

### **Cabinet Secretaries**

Secretary of the Interior  
Washington, D.C.

Represented by:

Joe Sax, September 1995 -  
October 1996

Patricia J. Beneke, November 1996

Secretary of the Army  
Washington, DC

Represented by:

Dr. John H. Zirschky

---

### ***Members of Congress (Ex-Officio Members):***

#### **U.S. Senate:** Committee on Energy and Natural Resources

Honorable Frank Murkowski, Chairman, represented by Jim Bierne, Senior Counsel

Honorable Dale Bumpers, Ranking Minority Member, represented by David Brooks, Senior Counsel

Honorable J. Bennett Johnston (September 1995 to January 1997), represented by David Brooks,  
Senior Counsel

#### **U.S. Senate:** Subcommittee on Water and Power, Committee on Energy and Natural Resources

Honorable Jon Kyl, Chairman, represented by Colleen Deegan, Legislative Assistant

Honorable Daniel K. Akaka, Ranking Minority Member, represented by Patrick McGarey,  
Legislative Director

Honorable Larry E. Craig (September 1995 to January 1997), represented by Nils Johnson, Natural  
Resources/Environmental Director

Honorable Bill Bradley (September 1995 to January 1997), represented by David Brooks, Senior  
Counsel

#### **U.S. Senate:** Committee on Appropriations

Honorable Ted Stevens, Chairman, represented by Jeff Staser, Legislative Assistant

Honorable Robert C. Byrd, Ranking Minority Member, represented by Gregory Daines, Legislative  
Staff

Honorable Mark O. Hatfield (September 1995 to January 1997), represented by Doug Pahl,  
Legislative Counsel, and David Robertson, Professional Staff

#### **U.S. House of Representatives:** Committee on Resources

Honorable Don Young, Chairman, represented by Valerie West, Legislative Staff, and Robert Faber,  
Staff Director

Honorable George Miller, Ranking Minority Member, represented by Steve Lanich, Legislative Staff

#### **U.S. House of Representatives:** Committee on Transportation and Infrastructure

Honorable Bud Shuster, Chairman, represented by Benjamin H. Grumbles, Majority Counsel

Honorable James L. Oberstar, Ranking Minority Member, represented by Kenneth J. Kopocis,  
Counsel

#### **U.S. House of Representatives:** Committee on Appropriations

Honorable Bob Livingston, Chairman, represented by Bob Schmidt, Staff Assistant, and James  
Ogsbury, Staff Assistant

Honorable David R. Obey, Ranking Minority Member, represented by Sally Chadbourne, Staff  
Assistant

---

Commission biographies appear in appendix A.

## ***Staff to the Commission***

### **Executive Directors**

Donald Glaser (9/96 - 4/98)  
Dr. Lawrence J. MacDonnell (2/96 - 5/96)

---

### **Writing/Editing Team**

Professor Dan Tarlock, Chicago Kent College of Law, Chicago, Illinois  
Sarah Van de Wetering, Consultant, Missoula, Montana  
Dr. Lawrence J. MacDonnell, Consultant, Boulder, Colorado  
Douglas Kenney, University of Colorado, Boulder, Colorado  
Jo Clark, Consultant, Boulder, Colorado  
Dr. Curtis A. Brown, Program Manager, Denver, Colorado  
Charlene Dougherty, Program Analyst, Denver, Colorado  
Donald Glaser, Executive Director, Denver, Colorado

### **Designated Federal Official**

David Cottingham

### **Program Manager**

Dr. Curtis A. Brown

### **Administrative Officer**

Larry Schulz

### **Program Analyst**

Charlene Dougherty

### **Secretary**

Patsy Cortez  
Ruth Gunnarson  
Joy Nelson

### **Research**

Spencer Shepherd, Esq.  
Cody Kelley  
James Loonam  
Donna Griffin  
Dominique Cartron  
James B. (Brian) Smith

### **Automation Specialists**

*Clerks*  
William Lindsey  
Sandra Peterson

### *Webmaster*

William Joe Simonds

## ***Acknowledgments***

In addition to the many authors who wrote reports, the following made special contributions or assistance to the Commission's work.

Senator Mark O. Hatfield, Portland, Oregon  
Craig Bell, Executive Director, Western States Water Council, Midvale, Utah  
Reed Benson, Water Watch of Oregon, Portland, Oregon  
Pat Chase, Arizona State University, Phoenix, Arizona  
Betsy Cody, Congressional Research Service, Washington, DC  
Shannon Cunniff, Issue Manager, Bureau of Reclamation, Washington, DC  
Cynthia Dyballa, Issue Manager, Bureau of Reclamation, Washington, DC  
Jeff Fassett, State Engineer, State of Wyoming, Cheyenne, Wyoming  
David Getches, University of Colorado School of Law, Boulder, Colorado

### ***Acknowledgments (continued)***

Don Gray, Environment and Energy Study Institute, Washington, DC  
Dorothy Johnson, Program Assistant, Northwest School of Law of Lewis and Clark College  
Jeanine Jones, Department of Water Resources, State of California, Sacramento, California  
John Keys, Regional Director, Pacific Northwest Region, Bureau of Reclamation, Boise, Idaho  
Don Leonard, Western Regional Council, Salt Lake City, Utah  
John Leshy, Department of the Interior, Washington, DC  
Ron Marlow, National Resources Conservation Service, Washington, DC  
Commissioner Eluid Martinez, Bureau of Reclamation, Washington, DC  
Dave Morrow, Bureau of Reclamation, Denver, Colorado  
Judy McElhaney, Bonneville Power Administration, Portland Oregon  
Roger Patterson, Regional Director, Mid-Pacific Region, Bureau of Reclamation, Sacramento, California  
Robert S. Pelcyger, Attorney, Louisville, Colorado  
Jan Rasgus, Army Corps of Engineers, Washington, DC  
Nancy Rogers, Bay Model Visitor Center, Army Corps of Engineers, Sausalito, California  
Jim Souby, Executive Director, Western Governor's Association  
Gregory Thomas, Natural Heritage Institute, California  
Lynn Tominaga, Idaho Water Users Association  
Judy Troast, Bureau of Reclamation, Washington, DC  
Dick Trudell, American Indian Resource Institute, Oakland, California  
Janice Weis, Director, Environmental and Natural Resources Law Program, Northwest School of Law of Lewis and Clark College  
Tony Willardson, Western States Water Council, Midvale, Utah

### ***Staff Support***

Document Editing and Design: Kathy House, Teri Manross, Sharon Leffel, Patty Alexander, Mary Voita, William W. White

Publications Specialists: Kathleen Bauer, Vickie Romero

Copy Unit: Jerry Luben, Mark Ohnemus, Joe Roybal, Trish Scarpello

Mailroom: Jan Beckett, Treva Busley-Smith, Kim Ettel, Eric Lang, Dorie McDonald, Randy Shader, Frank Vigil, Roger Villalobos

***Federal Agency Representatives:***

Mr. John H. Clements, Federal Energy Regulatory Commission, Washington, DC  
Mr. Phil Metzger, Environmental Protection Agency, Washington, DC  
Mr. Thomas Hebert, U.S. Department of Agriculture, Washington, DC  
Mr. Art Bryant, United States Forest Service, Washington, DC  
Mr. Ron Marlow, National Resource Conservation Service, Washington, DC  
Mr. James Lecky, National Marine Fisheries Service, Long Beach, California  
Ms. Catherine Vandemoer, Bureau of Indian Affairs, Washington, DC  
Mr. Tom Walker, Bureau of Land Management, Washington, DC  
Mr. Zell Steever, Bureau of Reclamation, Washington, DC  
John M. Klein, U.S. Geological Survey, Sacramento, California  
Dan Smalley, U.S. Fish and Wildlife Service, Arlington, Virginia

***State Liaisons (Appointed by State Governors):***

Len Virelli, Department of Environmental Conservation, Juneau, Alaska  
Rita Pearson, Department of Water Resources, Phoenix, Arizona  
Jeanine Jones, Department of Water Resources, Sacramento, California  
Jim Lochhead, Colorado Department of Natural Resources, Denver, Colorado  
Rae Loui, Land and Natural Resources Department, Honolulu, Hawaii  
Karl Dreher, Idaho Department of Water Resources, Boise, Idaho  
Derinda Mitchell, Legislative Counsel, State of Kansas, Topeka, Kansas  
Bud Clinch, Natural Resources and Conservation Department, Helena, Montana  
J. Michael Jess, Water Resources Department, Lincoln, Nebraska  
Peter Morros, Conservation and Natural Resources Department, Carson City, Nevada  
Thomas C. Turney, State of New Mexico, Santa Fe, New Mexico  
David Sprynczynatyk, State Water Commission, Bismarck, North Dakota  
Gary Sherrer, Water Resources Board, Oklahoma City, Oklahoma  
Martha Pagel, Water Resources Department, Salem, Oregon  
Joe Nadenicek, Department of Environmental and Natural Resources, Pierre, South Dakota  
John M. Baker Jr., Texas Natural Resources Conservation Commission, Austin, Texas  
D. Larry Anderson, Division of Water Resources, Salt Lake City, Utah  
Ken Slattery, Department of Ecology, Olympia, Washington  
Jeff Fassett, State Engineer's Office, Cheyenne, Wyoming



## ***Reports to the Commission***

### ***Research Reports to the Commission:***

#### ***Aquatic Ecosystems Symposium***

Edited by Dr. W.L. Minckley, Arizona  
State University

#### ***A Survey of Columbia River Basin Water Law Institutions and Policies***

Northwest Water Law and Policy Project  
of the Natural Resources Law Institute,  
Northwestern School of Law of Lewis &  
Clark College

#### ***Budgeting for Federal Water Projects***

EOP Foundation, Inc.

#### ***Climate Variability, Climate Change, and Western Water***

Dr. Kathleen A. Miller, National Center  
for Atmospheric Research

#### ***Estimates of Water Use in the Western United States in 1990, and Water-Use Trends, 1960-90***

Dr. Wayne B. Solley, U.S. Geological  
Survey

#### ***House and Senate Committee Jurisdiction and Executive Branch Responsibility Over Water Resources***

Congressional Research Service

#### ***Improving Drought Management in the West***

Dr. Donald Wilhite, National Drought  
Mitigation Center, University of  
Nebraska

#### ***Indian Water—1997, Trends and Directions in Federal Water Policy: A Summary of the Conference Proceedings***

Todd Olinger

#### ***Patterns of Demographic, Economic, and Value Change in the Western United States: Implications for Water Use and Management***

Dr. Pamela Case and Gregory Alward,  
U.S. Forest Service

#### ***Resource Management at the Watershed Level: An Assessment of the Changing Federal Role in the Emerging Era of Community-Based Watershed Management***

Betsy Rieke and Dr. Douglas S. Kenney,  
Natural Resources Law Center,  
University of Colorado

#### ***Seeking Solutions: Alternative Dispute Resolution and Western Water Issues***

Dr. Gail Bingham, RESOLVE, Inc.

#### ***Water in the West Today: A States’ Perspective***

D. Craig Bell, Western States Water  
Council

#### ***Water Quality in the West***

Gene Reetz, EPA Region VIII

#### ***Western Hydropower: Changing Values/New Visions***

Bruce Driver

#### ***Western Land Use Trends and Policy Implications for Water Resources***

Dr. William E. Riebsame, University of  
Colorado

#### ***The Upper Basins’ Political Conundrum: A Deal is Not a Deal***

J. William McDonald, Office of the  
Solicitor, Department of the Interior

### ***River Basin Reports to the Commission:***

#### ***A River in Common: The Columbia River, the Salmon Ecosystem, and Water Policy***

John M. Volkman

#### ***Colorado River Basin Study***

Dale Pontius

#### ***Platte River Basin Study***

Leo Eisel, McLaughlin Water Engineers,  
Ltd, and Professor J. David Aiken,  
University of Nebraska

#### ***Sacramento-San Joaquin River Basin Study***

Sue McClurg, Water Education,  
Foundation

#### ***Truckee-Carson River Basin Study***

Jeremy Pratt, Clearwater Consulting  
Corporation

#### ***Water Management Study: Upper Rio Grande River Basin***

Ernie Niemi, ECONorthwest



*The Commission thanks the following for their invited presentations:*

Honorable Jesse Taken Alive, *Chairman*,  
Standing Rock Sioux Tribal Council

Robert T. Anderson, *Consultant*, Department of  
the Interior

Dan Beard, Director, Washington Office, National  
Audubon Society; former Commissioner,  
Bureau of Reclamation

Alleta Belin, Assistant Attorney General, State of  
New Mexico

Reed Benson, Oregon Water Watch

Honorable Henry Cagey, *Chairman*, Lummi  
Business Council

Judy Calica, *General Manager*, Natural Resources  
Department, Confederated Tribes of the Warm  
Springs Indian Reservation

Sherl Chapman, Executive Director, Idaho Water  
Users

Jo Clark, Clark Consulting, Boulder, Colorado

Chelsea Congdon, *Western Water Resources  
Analyst*, Environmental Defense Fund

David Conrad, National Wildlife Federation

Michael Davis, Deputy Assistant Secretary, Civil  
Works, United States Corps of Engineers

James Deacon, Chair, Department of  
Environmental Studies, University of Nevada,  
Las Vegas, Nevada

Max Dodson, Region 8, Environmental Protection  
Agency

Christopher Estes, Instream Flow Coordinator,  
Alaska Game & Fish Department

Billy Frank, Jr., *Chairman*, Northwest Indian  
Fisheries Commission

Thomas W. Fredericks, *Tribal Water Attorney*,  
Fort Belknap Indian Reservation, *Partner*,  
Fredericks, Pelcyger, Hester & White

Jack Garner, Manager, Eastern Plains Area Office,  
Bureau of Reclamation

David H. Getches, *Raphael J. Moses Professor of  
Natural Resources Law*, University of  
Colorado School of Law

Timothy Glidden, *Counsel*, Resources Committee,  
U.S. House of Representatives

Rick Gold, Deputy Regional Director, Upper  
Colorado Region, Bureau of Reclamation

Will Graf, Regents Professor of Geography,  
Arizona State University

Nancy Grimm, Associate Research Professor,  
Department of Zoology, Arizona State  
University

Honorable Albert Hale, *President*, Navajo Nation

Eric Hammerling, National Fish and Wildlife  
Foundation

Senator Mark O. Hatfield, Portland, Oregon

Brad Hilscher, Legislative Representative,  
Metropolitan Water District

David Holm, Director, Colorado Water Quality  
Division

Michael Jackson, *Minority Professional Staff  
Member*, Indian Affairs Committee,  
U.S. Senate

Robert Johnson, Regional Director, Lower  
Colorado Region, Bureau of Reclamation

Jesse Juan, Area Manager, Tucson Resource Area,  
Bureau of Land Management

***Presentations (continued)***

Jeff Keidel, Upper Arkansas River Coordinator,  
Bureau of Reclamation

John Keyes, Region Director, Pacific Northwest  
Region, Bureau of Reclamation

Honorable Judy Frank-Knight, *Chairperson*, Ute  
Mountain Ute Tribe

Warren Lee, Director, Program Manager, Pacific  
Northwest Research Station, National  
Resource Conservation Service

Rodney B. Lewis, *General Counsel*, Gila River  
Indian Community

Jim Lochhead, Executive Director, Colorado  
Department of Natural Resources

Dan Luecke, Environmental Defense Fund

Honorable Ronnie Lupe, *Chairman*, White  
Mountain Apache Tribe Council

Michael Mantell, Deputy Secretary, California  
Department of Natural Resources

Hilda Manuel, *Deputy Commissioner*, Bureau of  
Indian Affairs, Department of the Interior

Mr. Ron Marlow, United States Department of  
Agriculture

Rob Masonis, American Rivers

Clayton Matt, *Manager*, Water Administration  
Program, Confederated Salish & Kootenai  
Tribes

John Meagher, Director, Wetlands Division,  
Office of Wetlands, Oceans, & Watersheds,  
Environmental Protection Agency

Ron Micheli, Executive Officer, Department of  
Agriculture, State of Wyoming

Richard Bad Moccasin, *Executive Director*, Mni-  
Sose Water Rights Coalition

Ralph Morgenweck, Regional Director, Region 6,  
Fish and Wildlife Service

Duncan Patten, Professor, Mountain Research  
Center, Montana State University

Robert S. Pelcyger, *Partner*, Fredricks, Pelcyger,  
Hesler & White

Honorable Samuel N. Penney, *Chairman*,  
Nez Perce Tribal Executive Council

Dale Pontius, Natural Resources Consultant,  
Pearce, Arizona

Mary Power, Professor, Department of Integrative  
Biology, University of California, Berkeley

Marc Reisner, Author, *Cadillac Desert*

Mr. Jean Sagouspe, Family Farm Alliance

Mr. Eric Saperstein, East Bay Municipal Utilities  
District

John Saven, Executive Director, Northwest  
Requirements Utilities

Mr. Theodore Schad, Executive Director of the  
National Water Commission

Dr. Jim Sedell, Program Manager, Pacific  
Northwest Research Station, U.S. Forest  
Service

Duane Shroufe, Director, Arizona Game & Fish  
Department

Scott Smith, Vice President, Coors Brewing  
Company

Dr. Wayne Solley, Hydrologist, United States  
Geological Survey

Will Stelle, Northwest Regional Director,  
National Marine Fisheries Service

***Presentations (continued)***

Mr. Ted Strong, Chairman, Columbia River  
Intertribal Fishing Council

Greg Thomas, National Heritage Institute,  
San Francisco, California

Richard Trudell, *Executive Director*, American  
Indian Resources Institute

Honorable John R. Washakie, *Chairman*,  
Shoshone Business Council, Wind River  
Indian Reservation

Mr. Robert Will and Mr. Pete Carlson,  
Metropolitan Water District, Will & Carlson

Susan M. Williams, *Partner*, Gover, Stetson &  
Williams, P.C.

Patricia M. Zell, *Democratic Staff Director &  
Chief Counsel*, Indian Affairs Committee,  
U.S. Senate

*The Commission held the following events and public meetings:*

***Basin Workshops***

<b>Basin/Area</b>	<b>Location</b>	<b>Date</b>
Colorado River	Phoenix, Arizona	February 26, 1996
Missouri River	Omaha, Nebraska	March 11, 1996
Kansas-Oklahoma-Texas Region	Oklahoma City, Oklahoma	April 9, 1996
Columbia River	Lewiston, Idaho	April 10, 1996
Platte River	Casper, Wyoming	April 12, 1996
Great Basin	Salt Lake City, Utah	April 15, 1996
Sacramento-San Joaquin Rivers	Sacramento, California	April 16, 1996
Platte River	Denver, Colorado	April 23, 1996
Rio Grande	Albuquerque, New Mexico	April 25, 1996

***Basin Study Kickoff Meetings***

<b>Basin</b>	<b>Location</b>
Colorado	Salt Lake City, Utah
Columbia	Portland, Oregon
Platte	Denver, Colorado
Sacramento-San Joaquin	Sacramento, California
Truckee-Carson	Reno, Nevada
Upper Rio Grande	Albuquerque

***Commission Meetings***

<b>Location</b>	<b>Dates</b>
Portland, Oregon	February 16-17, 1996
Denver, Colorado	May 16-17, 1996
Denver, Colorado, by conference call	September 12, 1996
San Diego, California	November 21-22, 1996
Tempe, Arizona	February 17-18, 1997
Phoenix, Arizona	March 17-18, 1997
Boulder, Colorado	April 17-19, 1997
Washington, DC	May 15-17, 1997
San Francisco, California	June 10-12, 1997
Boise, Idaho	July 10-12, 1997
Denver, Colorado	September 4-6, 1997
Boulder, Colorado	February 19, 1998

---

# Executive Summary

---

*"Water is the true wealth in a dry land."*

— Wallace Stegner

In directing the Western Water Policy Review Advisory Commission (Commission) to make recommendations about the proper role of the federal government in western water management for the next 20 years, the Congress gave our Commission a daunting task. For the past year and a half, we have labored to understand the details of numerous and often conflicting federal programs while striving not to lose sight of the "big picture."

Though many previous studies have documented the chronic problems of water in the West, the convergence of a number of trends makes this study unique and timely. Early in our tenure, we learned that western water planners for the 21st century must address staggering growth projections. For the past 15 years, the West has been experiencing the most dramatic demographic changes for any region or period in the country's history. Should present trends continue, by 2020 population in the West may increase by more than 30 percent. The West is rapidly becoming a series of urban archipelagos (e.g., Denver, Salt Lake City, Boise, Missoula, Portland, Phoenix, Albuquerque, Dallas, Houston, and Seattle) arrayed across a mostly arid landscape.

At the same time, reports to the Commission identified unhealthy trends in aquatic ecosystems and water quality, pressing water supply problems, unfilled American Indian water claims, an

agricultural economy suffering the stress of transition, rapid conversion of open space to urban development, and rising drought and flood damage exacerbated by the potential for global warming. Additional population growth will only cause these crises to worsen unless bold action is taken. Population predictions underscore the urgency for wise long-range water policy planning, effective and efficient water management institutions, and consistent enforcement of existing laws.

Part of the impetus for our Commission's formation was the Congress's finding that current federal water policy suffers from unclear and conflicting goals implemented by a maze of agencies and programs. This finding was reinforced and documented by the Commission's investigation. Lack of policy clarity and coordination resulting in gridlock was a consistent theme of public testimony and scholarly research. We have concluded that these problems cannot be resolved piecemeal but, rather, must be addressed by fundamental changes in institutional structure and government process. Moreover, our work led us to an even more basic conclusion: that the geographic, hydrologic, ecologic, social, and economic diversity of the West will require regionally and locally tailored solutions to effectively meet the challenges of the 21st century of water management.

The lives of westerners and the places we live are changing so rapidly that irreversible developments are often not preceded by thoughtful policy

---

discussion and choices. In this report, we offer suggestions for addressing water problems in a proactive manner that will foster the necessary policy discussion and integrate the increasingly complex interests in western water.

This summary describes the many recommendations offered by the Commission. Two areas are highlighted first because they received the widest support among the diverse group of Commission members—Principles of Water Management for the 21st Century and New Governance of Watersheds and River Basins.

### ***Principles of Water Management for the 21st Century***

The Commission proposes principles by which any federal water program should be guided or judged against. The first principle, sustainable use of water, is adopted from the President's Council on Sustainable Development and forms the backbone of the Commission's recommendations. Both internationally and domestically, sustainable development links together the diverse elements of the water use community and provides the basis for common dialogue and problemsolving. Sustainable water use seeks to achieve a balance between the capability of a system to meet social needs and its biological capacity.

#### **Ensure Sustainable Use of Resources**

Use and manage water and related resources so that at the national, regional, and local levels, environmental, social, economic, and cultural values can be supported indefinitely. All water resources policies and programs in the West must recognize and address the dramatic current trends in

population growth and movement. Consideration must be given at all levels of government to growth impacts on water and associated land and open space resources. Policies which encourage growth must be assessed carefully in relation to the available resource base.

#### **Maintain National Goals and Standards**

National standards and goals for the quality of water and related resources play a valuable role in the maintenance and restoration of resource health. There is a continuing need for national standards and goals.

#### **Emphasize Local Implementation, Innovation, and Responsibility**

Federal, tribal, state, and local cooperation toward achieving national standards should be the basis of water policy. Where possible, responsibility and authority for achieving these national standards should rest with nonfederal governing entities. Reasonable flexibility should be allowed and innovation encouraged in the approaches taken to achieve national standards within a framework of monitoring and accountability.

#### **Provide Incentives**

Wherever possible, use economic and other incentives to achieve national, regional, or local water resource goals. Existing incentives and policies for water use and associated land management should be examined to determine whether they promote or impede sustainable use of resources and serve contemporary social goals. Funding should be used to provide incentives for state and local entities to achieve resource goals.

## **Respect Existing Rights**

Acknowledge and respect existing treaties, compacts, and equitable apportionments with states and tribes. Respect and give appropriate legal deference to existing water rights and state water appropriation systems.

## **Promote Social Equity**

Determine and fulfill tribal rights to water. Universal access to safe domestic water supplies should be a priority. We must also recognize that local economies have developed throughout the West as a result of government policies designed to encourage certain land and water uses. As those policies evolve, regardless of the reason, people and communities affected by such changes may need time and assistance to make a transition. Water transfers should be carried out with full consideration of the communities of origin, third party transfers, and unintentional consequences, and should be open to participation by affected parties.

## **Organize Around Hydrologic Systems**

Strive to make state and federal water programs and decisionmaking more efficient and effective. To help address the problems created by multiple and often conflicting jurisdictions, authorities, and program objectives, we should organize or integrate water planning, programs, agencies, funding, and decisionmaking around natural systems—the watersheds and river basins. This will require integrating institutional missions, budgets, and programs, as well as their congressional oversight. Duplicative or overlapping programs and activities should be integrated or modified. Planning and management of land and water, surface and groundwater, water quantity and quality, and point and nonpoint pollution must be coordinated at the appropriate level of government.

## **Ensure Measurable Objectives, Sound Science, Adaptive Management**

National, regional, and local water resource goals should be translated into measurable objectives. Performance should be assessed through open, objective, scientific studies, subject to peer review. Where knowledge is incomplete, actions should be based upon the best available data within a framework of monitoring and adaptive management. Determination of the best use of resources should take into account social, economic, environmental, and cultural values.

## **Employ Participatory Decisionmaking**

National, regional, and local resource decision-making must be open to involvement and meaningful participation by affected governments as well as interested and affected stakeholders. Sufficient information about the consequences of resource decisions should be made available to the public.

## **Provide Innovative Funding**

Given declining federal budgets, innovative sources of funding and investment, including public and private partnerships, must be found for the management and restoration of western rivers.

## ***New Governance of Watersheds and River Basins***

The Commission investigated numerous examples of local watershed initiatives, watershed councils, basin trusts, citizen advisory groups, and collaborative governmental partnerships that are springing up around the West to address critical problems of water supply, water quality,



environmental degradation, quality of life concerns, and compliance with interrelated federal, state and local laws. We believe that these initiatives hold much promise for meeting the growing challenges of western water management. To accept local participation is not simply to engage in a democratic exercise, but to recognize the growing need for (1) sustainable, local economies and energetic stakeholder consensus to replace frustration and dissension; (2) alternative sources of revenue to supplement federal appropriations; (3) coordinated and clarified regulatory requirements to reduce governmental gridlock; and (4) policy-relevant science to better inform program and budget decisions.

From the bottom up, the new federal challenge is to encourage local innovation, to effectively participate with local stakeholders in watershed groups and watershed councils, and to integrate them with federal, tribal, local, and state governmental requirements.

From the top down, the federal challenge is to establish policies which direct the federal resource agencies to coordinate their activities throughout hydrologic regions. This approach will require establishment of a national policy of interagency coordination which cascades down to regional offices and field personnel. It will also require better budgetary coordination to stimulate true integration of all federal water activities in each locale.

Accomplishment of these objectives will drive fundamental change in the structure of the federal government. We anticipate that during the next century, the federal resources management agencies will undergo widespread realignment of their organizational and enforcement functions. Recognizing how slowly governmental institutions change, in this report we recommend a partial reorganization of functions which can be immediately implemented within the present

governmental agency framework. While we reaffirm many existing goals and programs, we suggest a recalibration of the way in which these goals are achieved.

We propose a change in the function and approach of the federal resource agencies to a "nested" governance structure. This new governance approach reflects the hydrologic, social, legal, and political reality of the watershed. Fundamental principles of those governance structures are: regional flexibility, participation of all affected stakeholders in formulating joint programs to effectuate shared objectives, and recognition that intensive interaction among federal, state, tribal, and local governmental entities and stakeholders is essential to design durable solutions.

As the Commission learned throughout its process, examples of new basin governance structures are already emerging across the West to realize these very goals. There should be great hope based upon the initial success of these new institutional processes, and their continuation should be embraced by the federal government. They take many forms, depending upon the nature of the issues, the number of states and federal agencies involved, the legal parameters, and the number and nature of stakeholder interests. We highlight many of these new processes throughout the Commission report. They include: the Northwest Power Planning Council on the Columbia River; the Bay Delta Accord and the CALFED process on the Sacramento and San Joaquin Rivers; the three-state cooperative agreement with the Department of the Interior on the Platte River; the Upper Colorado Fish Recovery Program and the Lower Colorado Multispecies Recovery Program on the Colorado River. These efforts are distinct in many ways because they reflect the unique needs of each basin. They also share many characteristics in common, including the support and voluntary involvement of all interested parties.

From these initiatives, we have formulated a vision of how governance of rivers might be retooled for the 21st century. Rather than representing "more government," this proposal acknowledges and incorporates the successes that westerners are already bringing about to make government more responsive to local needs. The federal government, along with other levels of government, has a substantial presence and exercises significant authority in most major western river basins. Nothing in the Commission's new governance vision would expand that role. Insofar as the federal presence is more limited in some basins, this proposal would not give additional authority to the federal government. What we propose would, instead, make existing governmental programs more coordinated and efficient by requiring that federal agencies better coordinate their activities within river basins. The federal agencies would also be required to work effectively with other levels of government as well as all stakeholders. At present, there is no requirement that federal agencies coordinate at a basin level. It is our belief that a successful coordination strategy must proceed on two fronts: federal agencies must be given a mandate and a mechanism to forge horizontal cooperation, and coordinated federal goals and programs must also be integrated vertically with state, tribal, and local activities.

The vertical integration must go in both directions. Appropriate federal objectives and requirements need to be clearly expressed and communicated from the basin level to local watershed groups. In turn, those very requirements should be informed by local needs and objectives. Funding should be directed to the local level, where appropriate, to realize and accomplish joint goals, and regional and local initiatives should be encouraged. Watershed councils, where they exist, are varied and unique entities, and they should not be bureaucratized nor recruited as arms of the federal government. Federal agencies should cooperate with them.

We believe that, in order to accomplish the desired level of coordination and cooperation, river basin forums should be created in which federal agencies; state, tribal, and local governments; and stakeholder groups can come together to set joint goals for improving conditions in the basin. We do not recommend any single template for these forums. In fact, our report discusses a number of different models that could be used, depending on the needs of any given basin. The federal government should continue to support experimentation by sponsoring pilot projects in a variety of basins.

Our recommendation that the federal government coordinate its agencies better is made with full awareness of the bureaucratic infighting and competition that could frustrate achievement of this goal. Budgetary disclosure, such as that which is now occurring in the Everglades restoration effort and in the Northwest Power Planning Council, enables the public to understand the federal resources that are being spent on a problem and to evaluate the effectiveness of that spending. Further, our research revealed how difficult it is for anyone to track federal proposals for a region without this sort of coordinated budgeting. If we are to have more public participation, more democracy in the management of a basin's rivers, we need to require that federal agencies coordinate their budget submittals, that they seek public comment on their proposals before they approach the Congress, and that they fully reveal to the public how money is being spent in a region. The experience in the Everglades and in the Columbia River basin demonstrates that this can be done: our proposal attempts to capture the rough contours of what should be done across the West.

Our vision of a new governance for western river basins includes the following specific suggestions, to be tested through pilot projects:

**(1) A new approach to governance based on hydrologic systems, linking basins and watersheds.**

The federal resource agencies in the basin will adopt practices which encourage, through financial support, in-kind services, and cooperative interaction, the growth of collaborative watershed groups and initiatives on which all stakeholders are fairly represented.

The federal agencies will develop a cooperative process at the river basin level, utilizing existing entities where they exist and involving the leaders of federal, tribal, state, and local agencies; watershed council leaders; and other stakeholders as appropriate, created for the purpose of determining jointly supported solutions to regional water problems.

This process will provide for increased coordination among the federal regional offices in the basin and will facilitate funding of programs proposed by watershed councils as well as the agencies. The President should issue an Executive order or memorandum/directive to the heads of federal agencies and Cabinet secretaries to require regional and/or watershed level coordination of agency budget requests. Agency budget requests pertaining to water resource management and development shall be subject to mandatory review for interagency programmatic coordination and consistency. The designated water resource management officials performing these reviews shall be located in the particular region they serve.

**(2) Basin-level objectives.**

The river basin planning process will lead to the joint development of measurable objectives for the basin, which comply with federal, tribal, state, and local substantive law, that will be communicated to interested parties in the basin including watershed councils.

**(3) A basin trust fund.**

The process will encourage the formation of basin accounts and basin trusts which integrate federal, state, tribal, and local funds with money or in-kind contributions from nongovernmental sources such as foundations, stakeholders, and utilities to fund activities that support basin objectives; once a fund is established, a mechanism should be developed which will permit retention of these funds in an interest-bearing reserve account or trust and facilitate carryover management of the funds on a sustained multiyear basis.

These funds, which may include federal appropriations, state funds, and local contributions, will be distributed in an orderly and equitable manner, primarily at the watershed level, to further established objectives for the basin.

**(4) A link with watershed councils.**

Watershed councils will develop plans and identify specific projects to accomplish their own unique local needs, consistent with the objectives established in basin plans. No specific process or format should be

required, in order to stimulate local innovation and flexibility; watershed councils will utilize integrated databases of federal agencies, state agencies, tribes, and other parties, as well as gather new information to establish baseline conditions and resources.

Watershed councils will provide a forum to educate stakeholders about applicable laws and requirements.

**(5) A greater consistency of proposed projects with federal, state, tribal, and local laws and regulations.**

Any project which is submitted by watershed councils to comply with the objective set at the basin level shall be presumed consistent with prevailing laws unless within 60 days it is found inconsistent by relevant authorities; this approach would be tested in pilot projects.

**(6) A greater reliance on adaptive management.**

There will be an orderly process for establishing baseline conditions and measuring results of specific projects to document the achievement of objectives and to adjust the basin plan and objectives as appropriate.

These new governance processes are already providing federal and state agencies, tribes, local agencies, and local organizations with tools to solve problems which, though complex at any level, are most effectively addressed by those most directly concerned. There may be a need for new federal authority to address the unique needs of these emerging governance structures, and it is the recommendation of the Commission that authority

be given for pilot efforts to test these approaches. It is hoped these ongoing efforts and future pilot projects will provide the executive branch and the Congress with the insight necessary to develop policies which maximize the efficiency of federal expenditures, increase effectiveness of the administrative programs, and unify governmental actions to achieve federal and other goals.

The following are brief summaries of the remaining Commission recommendations. More details are provided in the main report.

### ***Tribal Water Rights***

A key objective of federal water policy is to assist tribes in meeting tribally defined goals regarding the use, management, and protection of their water and water rights. The federal government needs to fulfill its trust responsibilities to Indian nations and tribes to secure and protect tribal water rights and to assist the nations and tribes in putting those rights to use. Federal contributions toward meeting these obligations should not be limited to potential federal liability for breach of trust but should recognize moral and legal obligations to protect and assist the tribes as well. The federal government should recognize that it has often failed to protect prior and paramount Indian water rights while encouraging and financing non-Indian water development.

The Congress should appropriate funds and authorize the development of water supply and sanitation systems to ensure that residents of reservations have sufficient potable water and modern sewage treatment facilities to maintain the public health and protect the environment. The Congress should also appropriate funds to support the rehabilitation and betterment of existing Indian irrigation projects to improve their efficiency and reduce their adverse impacts on the environment.

## *Restoration of Aquatic Ecosystems*

Many aquatic systems in the American West are degraded and must be restored if they are to be sustainable. By "restoring" aquatic ecosystems, the Commission does not mean returning these systems to predisturbance or predevelopment conditions; rather, the Commission's overall goal is to restore the systems in order that important functions can be recovered and benefits can be realized and sustained over time.

The Commission notes that, in general, federal environmental laws such as the Endangered Species Act and the Clean Water Act have played important roles in protecting and, in some cases, requiring the restoration of aquatic ecosystems. While some changes are necessary to improve the implementation of these laws, the Commission believes these laws continue to be important in ensuring that aquatic and other ecosystems are protected and in setting the parameters within which locally driven watershed initiatives operate.

No comprehensive river restoration program exists. To date, river restoration efforts have not always been formulated in a coordinated and prioritized manner. Ecological risk assessment should be used across the West to gauge where federal support is most needed for restoration. Federal agencies should work with states, tribes, and others to develop and implement comprehensive project plans which take into account social and economic factors to:

1. Improve water quality in western waterways to meet state water quality standards and to support designated uses established by states and tribes pursuant to the Clean Water Act (such as swimming, fishing, and support of aquatic life).
2. Recover and protect threatened and endangered aquatic species and other species at risk.
3. Specifically recognize the benefits of conserving native species, communities, and ecosystems; take steps to sustain native species through activities and programs which will maintain, restore, and enhance instream, riparian, and upland habitat and wetlands; and remove barriers to fish migration, spawning, and rearing. Such actions can potentially prevent additional listings under the Endangered Species Act.
4. Insure sufficient instream flows to achieve and protect the natural functions of riverine, riparian, and flood plain ecosystems. Provide consideration for upstream reservoir and lake habitat.
5. Eradicate and control the spread of exotic and non-native species and pests (e.g., zebra mussels, purple loosestrife) as appropriate by establishing monitoring, inspection, eradication, and public education programs.
6. Identify and remediate contaminated sites that are degrading aquatic ecosystems.

## *Water Quality*

Despite progress in the quality of western water resources, significant problems remain to be addressed. These include: (a) nonpoint source runoff and discharges; (b) poor integration of land and water management; (c) inadequate management of some specific sources of water quality impairment; (d) inadequate water quality standards

for some uses of water; (e) poor integration of groundwater and surface water pollution control programs; (f) poor coordination of water quality and water use programs; (g) insufficient attention to more holistic and integrated approaches to water quality protection and improvement; and (h) inadequate water quality monitoring.

## Water Quality Standards

The water quality of western rivers presents issues that are often different from those in the eastern United States. There is little recognition of this in the Clean Water Act or in the programs of the Environmental Protection Agency (EPA).

1. EPA, the U.S. Geological Survey (USGS), and the states should broaden their water quality monitoring to enable them to knowledgeably assess the condition of western (and the nation's) aquatic ecosystems.
2. Western ephemeral streams in arid areas, dry many months of the year, with aquatic ecosystems that can be vastly different from year-round water bodies, present a unique challenge under the Clean Water Act. The Commission supports EPA's effort to find ways to treat these aquatic ecosystems as a separate type of water use and to develop a more appropriate, though equally protective, set of water quality criteria that states and tribes may use in setting water quality standards that protect these ecosystems and their species and habitats. The Commission also encourages states to develop biological criteria to help define the biological integrity of the state's waters.
3. Hydrologic modification activities are increasingly a source of concern in western

aquatic ecosystems, ranking third nationally as a source of water quality impairment for rivers. Water quality criteria and best management practices should be aggressively developed that encourage states to pursue instream flow and other standards for protection of the physical and biological aspects of instream water quality as appropriate.

## Nonpoint Sources of Pollution

Despite extensive program efforts and expenditures under the voluntary programs of the Clean Water Act and the farm bills, and establishment of soil loss limits by the Natural Resources Conservation Service of the Department of Agriculture, the problem of nonpoint source discharge continues and threatens to undermine the considerable national success in addressing point sources of water pollution. Nonpoint source programs must be implemented more aggressively by states, with active support and cooperation of the federal government. These programs should, from wherever feasible, emphasize incentives for adoption of best land management practices and be designed so that they can be implemented flexibly at the watershed level. The Congress should consider modifying or changing the Clean Water Act approach to nonpoint sources (found in sections 208 and 319) to that of the Coastal Zone Management Act.

The EPA and the states should more actively pursue cooperative implementation of the watershed-based total maximum daily load process. Two promising areas are a reformed system of nonpoint source best management practices and pollutant trading systems developed on a watershed basis.

## **Integrating Land and Water Quality Management**

The federal government is a substantial land and water manager in the West and, therefore, has important obligations in this area. The mission and authority of each federal water and land management agency—including the Corps of Engineers, Bureau of Reclamation (Reclamation), Forest Service, Bureau of Indian Affairs, Bureau of Land Management, U.S. Fish and Wildlife Service, and National Park Service—should explicitly include land management goals and strategies to improve water quality, particularly from nonpoint sources. Federal agencies should be held to the same water quality protection practices as others.

## **Specific Sources of Water Quality Impairment**

Discharges from publicly owned wastewater treatment works that are utilized beyond their capacity are a potential cause of water quality impairment in specific western water bodies. The states and EPA should carefully monitor the water quality impacts of growth in the West and assure that growth does not outstrip current and future waste treatment capacity.

Among the most serious unregulated forms of water pollution is that generated by irrigated agriculture through irrigation and drainage districts. Irrigation return flows can, in certain situations, contain toxic constituents as well as salts, pesticides, and fertilizers. Some of these discharges are particularly well-suited to be designated as "point sources," as they often enter waterways through discrete and specific points—pipes and ditches—after being collected in carefully engineered systems. These point source discharges were exempted by the Congress from Clean Water Act requirements; that exemption should be reconsidered.

The large and growing number of sizeable confined animal-feeding operations represents an ever-increasing threat to surface water and groundwater quality. Under the Clean Water Act, most such feedlots are point sources in the technical sense only, but they are generally treated as exempt from regulation in the practical sense. Clean Water Act authorities should be applied to require that all confined animal feeding operations operate under the National Pollutant Discharge Elimination System (NPDES).

## **Groundwater-Surface Water Linkage**

Because of the hydrologic link between surface and groundwater, the discharge of pollutants into groundwater from a wide range of sources should be subject to a rigorous system of management under the Clean Water Act, such as the NPDES or the nonpoint source best management practices programs, or through watershed management approaches.

## **Water Use and Water Quality Linkage**

The Commission joins with many other voices in noting that water quality and water use systems are not integrated or effectively coordinated at the federal, state, or local level. The relationships between water use (water allocation and water rights) decisions and water quality management should be recognized at all levels of government decisionmaking, while acknowledging that the Congress determined that "the authority of each state to allocate quantities of water within its jurisdiction shall not be superseded, abrogated, or otherwise impaired by this [Clean Water] Act." Federal agencies with water management responsibilities should recognize that storage and diversions for water use can have a locally significant adverse effect on instream water quality in western states.



## ***Management of Water and Water Facilities***

### **Water Supply**

The Commission recognizes that additional water supplies will be needed to address growing consumptive needs, environmental needs, and tribal water rights. Emphasis in new supply development should be given to smaller, offstream storage; to more efficient storage such as conjunctive use of surface and groundwater; to water recycling; and to risk-sharing approaches.

### **Groundwater Management**

State law should recognize and take account of the substantial interrelation of surface water and groundwater. Rights in both sources of supply should be integrated, and uses should be administered and managed conjunctively. The Congress should require state conjunctive management of groundwater and regulation of withdrawals as a condition of federal financial assistance for construction of new water storage projects or other federally funded activities.

### **Drought Management**

An interagency task force should be established to develop an integrated national drought policy and plan that emphasizes a preventive, anticipatory, risk management approach to drought management and promotes self-reliance. (Work has begun toward this goal. A task force has recently been initiated for the western United States by cooperative agreement among the Department of Agriculture, Department of the Interior, the Federal Emergency Management Agency [FEMA], and the Western Governors' Association; this task force should be expanded to include other federal agencies.)

### **Water Conservation and Efficiency**

Water conservation, or improved efficiency of use, can have many benefits and should be the first approach considered for extending or augmenting available supplies. The Commission, therefore, recommends that the Secretaries of the Interior, Defense, and Agriculture should actively encourage and work with users of federal project water to improve project water use efficiency and onfarm water use efficiencies wherever there is reasonable expectation that significant public purposes might be served. In these cases, the Administration should provide incentives and technical and educational assistance for contracting agencies and water users. Many Reclamation irrigation districts have very limited information on water deliveries and use, making a basic calculation of system efficiency difficult. Such data are prerequisite to assessing feasible options for improving water management.

### **Pricing**

For new or renewed water service contracts, federal agencies should seriously consider pricing their services closer to the full cost to the taxpayers of providing the service and, if appropriate, promote water rate structures that encourage efficient water use. In considering proposals for new projects for water-related services, the Congress should carefully evaluate the merits of proposed financial arrangements that provide water and other services to project beneficiaries at less than their full cost.

### **Operation of Dams and Water Delivery Systems**

The Commission recommends that the Secretaries of the Interior and Defense and the Chairman of the Federal Energy Regulatory Commission be directed to prepare and submit to the Congress for each of the dams they manage a brief assessment of the

value of undertaking a systematic review of the dam's purposes, authorities, and operations. Public scoping should be part of this process. The agencies should then be authorized and directed to undertake such reviews, prioritized based on the results of the scoping. Any need for modifying a facility's structures, project authorities and purposes, operations, project beneficiaries, or cost allocations should be identified through a public planning process and reported to the Congress if statutory changes are required. The Congress should provide funding and authority for those changes which appear to improve the way water projects serve public needs, while addressing equitably the rights as well as the financial obligations of current water users.

## Water Marketing and Transfers

The Commission finds that water transfers are an essential part of any discussion of the future of the West and its water, particularly given growth projections. Voluntary water transfers are occurring throughout the West and are helping to meet the demand for new urban supplies and for environmental flows in a manner that is both fair and efficient. They are also a critical aspect of viable Indian water rights settlements. However, water transfers that occur without attention to their potentially damaging effects on local communities, economies, and environments can be harmful to ecosystems and social systems that are dependent on irrigation economies.

In view of the potential usefulness of voluntary water transfers as a means of responding to changing demands for use of water resources, federal agencies should facilitate voluntary water transfers as a component of policies for overall water management, subject to processes designed to protect well-defined third party interests. The Congress should review existing water resources

legislation in order to assure that federal law does not impede voluntary water transfers.

State and local jurisdictions should provide clear rules governing a community's right to participate in proceedings regarding transfers from an area.

## Enforcement of Reclamation Law

Reclamation should also take steps to ensure that water use from Reclamation projects is in compliance with project authorities and federal Reclamation law.

## Flood Plain Management

The 1997 floods in California, Nevada, and the upper Midwest, along with the 1993 Midwest/ Mississippi floods, demonstrate the need for an overarching flood plain management policy to consistently achieve the nation's policies of flood control, disaster prevention and mitigation, disaster relief, and environmental restoration.

1. The major recommendations of the 1994 report, *Sharing the Challenge: Floodplain Management into the 21st Century* (the Galloway Report) should be adopted and implemented.
  - a. The responsibility for flood plain damage reduction through flood plain management should be shared among all levels of government and by those at risk of flooding.
  - b. Enhanced organization and consistency of government activities would further flood plain management and reduce future flood damage.

- c. The reduction of vulnerability to flood damages should be pursued by giving full consideration to all possible alternatives, including permanent evacuation of the flood-prone areas, flood warning, floodproofing structures remaining in the flood plain, creating additional natural and artificial storage, and adequately sizing and maintaining levees and other structures.
2. Development of flood plains should not be subsidized by the federal government. This recommendation is made, in part, to minimize the increasing losses of life and property as a result of flooding events and, in part, to provide the flood storage, flood conveyance, and environmental benefits associated with healthy riparian and riverine ecosystems.
3. All federal expenditures for flood plain management and disaster relief should consistently encourage responsible behavior and discourage behavior likely to lead to future loss of life and property. The Administration should establish a policy that communities and individuals that are eligible to purchase flood insurance and have failed to do so are not eligible for major federal disaster assistance, except for such assistance as is needed to provide for immediate health, safety, and welfare and to provide a safety net for low-income flood victims. The Administration should increase incentives for communities that participate in flood plain management planning through FEMA's National Flood Insurance Program Community Rating Systems.
4. The Administration should pursue, and the Congress should adopt, a change in law to require 50/50 cost sharing among federal

and local governments for funding future structural flood control projects. For nonstructural approaches to flood mitigation, the federal government should fund up to 75 percent.

5. The federal government should more aggressively pursue nontraditional solutions, including purchasing flood plain lands or flood easements, creating setback levees, restoring wetlands and natural storage areas, requiring floodproof structures on the flood plain, and allowing for natural pooling of rivers in lightly populated areas.

## ***Maintaining the Water Infrastructure***

The Commission recommends that the Congress and the federal water agencies:

1. Acknowledge the importance of sufficient funding for operation and maintenance of significant federal facilities upon which the public relies for water supply.
2. Recognize the fiscal benefits of preventive maintenance.
3. Place greater importance on maintenance and rehabilitation of key existing federal water infrastructure than on funding for new projects.
4. Develop a long-range approach to maintenance, considering expanded use of user fees and other cost-sharing approaches.
5. Explore further application of revolving funds and similar mechanisms which allow needed maintenance to be accomplished in a more timely and efficient fashion.

6. Continue to vigorously pursue means to reduce costs of operation.

### **Transfer of Federal Facilities**

The Commission believes that it is desirable to transfer assets out of federal ownership in those situations in which the new owner can manage those assets as well as or better than, and at less cost than, the federal government. We concur with the Administration's requirement that transfers be in compliance with environmental laws, that the public be involved in the transfer process, that Native American trust responsibilities be met, and that taxpayers' interests be protected.

We recommend that agencies contemplating facility transfers establish criteria for the transfer of title such as those prepared by Reclamation and that such criteria be consistent among the agencies.

The Commission recommends that the federal government continue to retain ownership of and control over large multipurpose federal water projects. It is important to recognize that these projects have critical functions important to multiple users, stakeholders, beneficiaries, and the public which should be protected. Few, if any, owners outside the federal government can provide adequate protection to these multiple, conflicting, and, often, interstate interests.

Similarly, the Commission is wary of privatization of federal hydropower assets. These assets are usually one component of multipurpose facilities that serve irrigation, municipal, recreation, and fish and wildlife purposes as well as power. It is not clear how these other needs might be met after privatization.

### ***Protecting Productive Agricultural Communities***

Over the last century, the farm population in the United States has declined steadily and dramatically, while the value of food production has increased. For the better part of this century, substantial assistance to agricultural production encouraged the expansion of low-priced food production for the United States and for export to the rest of the world. Some of the expansion occurred in areas which were economically marginal or which damaged important natural resources. As federal supports are reduced, further contraction and restructuring of agriculture are likely, and the family farm and ranch are at risk.

At the same time, farm and ranchlands in many parts of the West are giving way to urban growth, suburban sprawl, and the growth of "ranchette" and luxury second homes in rural areas. While this has been financially beneficial to many individual farmers, in some areas the conversion of agricultural lands to other uses has had a serious impact on traditional economies and cultures.

Particularly in the interior West, existing ranching and farming operations are concentrated along riparian corridors, in flood plains and rich bottomlands. While these operations sometimes have negative environmental impacts on riparian resources, they also maintain the area as relatively undeveloped land, providing important benefits to wildlife and open space.

Maintaining these important benefits from farming and ranching operations in the face of changing national and international economies and the tidal pressure of urban growth is a complicated and difficult task, requiring attention from the federal, state, and local levels. It is the judgment of the

Commission that, in the majority of cases, federal water policy affects but does not drive these trends or changes. We do recommend:

1. That federal water policy not subsidize nonagricultural growth and development into agricultural areas.
2. That state and local officials give more attention to putting growth on a sustainable basis.
3. That federal agencies participate with and encourage local efforts to develop plans for land use that preserve the important economic, environmental, cultural, and amenity value of open agricultural and ranchlands.
4. That federal water agencies develop or continue programs that support sustainable agriculture by:
  - a. Strengthening locally led conservation partnerships by ensuring a strong base program of technical assistance and financial incentives to address the array of water resources issues.
  - b. Assisting in development of water conservation plans for districts contracting for federal water supplies.
  - c. Providing loans, grants, and other financial assistance that promote flexible water conservation on farmlands and other lands.
  - d. Conducting research to improve and promote water conservation.
  - e. Facilitating water transfers and marketing of federally supplied water within states that benefit both water conservation and the financial viability of agricultural operations.
5. That irrigation districts, water management agencies, tribes, local and state officials, stakeholders, and affected publics work together to anticipate demands for water conversion and to develop approaches for such conversion that protect the integrity of communities and the environment.

## ***Improving Decisionmaking, Reducing Conflict***

### **Coordinating Federal Policy**

The most recent institution charged with coordinating federal water policy was the Water Resources Council, created by the 1965 Water Resources Planning Act and defunded in 1981. Since then, coordination of federal water programs, when it has occurred, has come variously from the Office of Management and Budget, the Council on Environmental Quality at the White House, and such ad hoc bodies as the Task Force on Floodplain Management. Today, most recognize that the world in which federal water policy functions is vastly changed from that overseen by the Water Resources Council. New, large federal water projects are not being funded or even proposed. Today, the need for policy development and coordination stems from the many environmental and social crises affecting the nation's rivers. In the West, federal agencies are responding to tribal water rights, endangered species listings, and Clean Water Act lawsuits in nearly every river basin.

The Commission believes that functioning river basin forums and processes as described above can play a major role in shaping, coordinating, and implementing federal policy at the regional level. However, we believe that there remains a need for national coordination of water policy and programs, especially as federal resources decline and the need for prioritysetting becomes more acute. At a time when our water resources policies are in such rapid transition, it is remarkable that there is no regular forum for discussion of these issues by involved federal officials.

### **Coordinating Federal Strategy**

The water problems that federal agencies deal with in the West today span the jurisdictions of several agencies and several departments (a detailed description of the jurisdictions and authorities of the various congressional committees and federal agencies related to water resources is in appendix C). However, only issues of major political or national significance can get sufficient attention from a Secretary or the President to resolve interdepartmental or intradepartmental conflict. For most problems, there is no forum to develop a coordinated approach; hence, the common criticism of federal agencies not "speaking with one voice." The Commission recommends, for issues of regional significance, the appointment of a designated official who has the responsibility to shepherd the issue on behalf of the President or Secretary as appropriate. This person would undertake to develop a clearly articulated federal objective to be clearly conveyed to field organizations and managers. The official would name a lead organization at the field level to coordinate federal activities and budgets and would designate a single point of legal counsel to coordinate all involved federal agency counsels.

### **The Federal Role in Research and Data Collection**

#### *Using Good Science*

Sound, unbiased data and analysis are a prerequisite to the success, efficiency, and economic prudence of many federal activities. The Commission recommends that when federal agencies undertake projects or programs which depend on new scientific research or knowledge, the agencies should bring expert review and contribution to research and monitoring plans, data analysis, and assessment of conclusions. Options include external review panels, such as National Research Council review committees, and publication in peer-reviewed journals. Also, joint investigations with universities and professional groups, project conferences, and symposia should be utilized.

#### *Adaptive Management*

When natural river systems and their associated biota are combined with extensive water control structures, the resulting network of inter-relationships is extraordinarily complex. The Commission endorses and encourages the use of adaptive management wherever long-term programs or projects are implemented or facilities are operated that may have significant impact upon valued environmental, social, economic, or other resources, and where significant uncertainty exists about the best management action or about its effects.

#### *Monitoring*

In its review of the first 25 years of implementation of the National Environmental Policy Act, the

Council on Environmental Quality concluded that, "In most cases at present, agencies do not collect long-term data on the actual environmental impacts of their projects. Nor do agencies generally gather data on the effectiveness of mitigation measures." Therefore, in addition to supporting the increased use of adaptive management, the Commission recommends that agencies give more attention to monitoring significant environmental resources, programs, and mitigation efforts.

### ***Water Research***

The Congress and the Administration should acknowledge the scarce nature of western water resources and should recognize that water resources research is a legitimate federal interest that should be supported. To address these issues, the Administration should propose and the Congress should fund a tightly structured research program. A substantial effort must be made to consult with state and other water managers to ensure that research is directed at high-priority problems and to coordinate research across the federal agencies so that limited research funds may be spent most efficiently.

### ***National Water Data***

Two critical needs have emerged related to federal water data collection programs: (1) improving efficiency and coordination in data collection, and (2) ensuring continuity and coverage in data collection.

The longstanding programs of the USGS to collect and publish basic streamflow information provide very important information to a broad community of water users and water management organizations. For many reasons, including increasing data collection costs and tighter state and federal budgets, the number of gauging stations being maintained has

declined substantially. The Commission received considerable comment about the need to maintain and ensure the continuity in this basic data collection program. Steps should be taken to develop among the agencies and cooperators a plan for this program that results in greater financial and programmatic stability, and this plan should be presented to the Congress for additional funding if needed.

Similarly, the collection, analysis, and publication by the USGS of water use data from the states has served as one of the few sources of information about regional or national trends in stream diversions, water supply, and use. As our focus on water management is increasingly on the river basin or watershed, often spanning multiple states, it is important to maintain this source of information for both its broad and historic view.

The USGS and the EPA are engaged in several water quality data collection programs, in concert with the states. The largest of these is the National Water Quality Assessment (NAWQA). To improve the coordination and efficiency of these data programs, we encourage the efforts of the Interagency Taskforce for Monitoring, which includes representatives from all levels of government, to conclude the development and implementation of a national strategy under the National Water Quality Monitoring Council. We strongly recommend that further steps be taken to add a focus within NAWQA on critical biological indicators, in addition to the physical and chemical variables currently assessed.

While groundwater use is an area of water management that is arguably the least sustainable in many areas given current practices, data on this resource is not systematically collected and coordinated, either by the states or the USGS. Groundwater management is an area often involving complex interrelationships, and it creates an increased need for data collection and analysis. A



more coordinated approach by local, state, and federal agencies seems prudent, given the heavy reliance on groundwater by agriculture in some regions and by municipal water users in many areas. The western states need good information about groundwater to make informed water management decisions. The resources to perform these studies vary by state, and the federal government's role in providing information can be critical. The USGS, in conjunction with state officials, should help quantify existing data bases and should make available any computer models, geophysical methodology, seismic information, or other tools that could be used to assist decisionmakers. The USGS should also engage in analysis of groundwater resources and provide policy relevant information such as forecasts of aquifer life to the water resources community.

## *Reasons for Hope*

The challenges ahead are daunting. Progress will require significant changes in our water institutions and the way that we manage our water resources. Steady political leadership will be essential. Yet, there are already many signs of progress.

All around the nation, individuals and communities are taking a greater role in stewardship of their natural resources. Hundreds if not thousands of watershed groups now exist nationwide. They have been organized for many reasons—to monitor water quality, to restore fish habitat, to improve recreation, to promote water-related economies. They are providing a community-based forum for resolving, at the local level, some of the most difficult kinds of water conflicts—instream flows, nonpoint source pollution, fish passage, and subdivision of riparian areas. They are achieving success often without regulatory intervention and with very meager funding because they capitalize on the sense of ownership and obligation to others that exists foremost at the community level.

These efforts illustrate an important point: individuals are most likely to recognize unsustainable resource use first when it affects their local environment. Thus, local watershed groups play a critical educational role and also represent a force for sustainable management at the basin level.

Residents of the West are also supporting improved resources management with their votes and dollars. The most notable example is the recent bond election in California, where voters approved hundreds of millions of dollars to help restore the Bay-Delta estuary and improve the reliability of water supplies.

Public support such as this is being mobilized frequently by strong federal-state partnerships, such as the Bay-Delta Accord, which demonstrate that with forward-looking political leadership, very difficult problems can be addressed in a collaborative way. Solutions are not simple or quick; but where good-faith efforts are undertaken, citizens have shown their willingness to provide the necessary funds.

As in the Bay-Delta effort to solve water problems, states in general are taking on a range of roles that is broader than their historic mission of enforcing water rights. They are becoming much more proactive in addressing issues that in the past might have been left to federal agencies or not addressed at all. For example, the Western Governors' Association is addressing the issue of land use planning and protection of open space from uncontrolled growth, traditionally not a politically profitable topic in the West.

The federal government, in turn, is experimenting with ways to make achievement of national environmental goals easier. The use of Habitat Conservation Plans, for example, is showing some promise of enlisting private landowners in cooperative efforts to more effectively protect ecosystems and habitats, rather than just individual

## Executive Summary

---

species. Concerted efforts are also being made to coordinate federal agency activities to make more efficient use of limited budgets as is being done for the Bay-Delta program, the Northwest Forest Plan, and the Everglades restoration.

In this report, the Commission has highlighted some of these promising new initiatives. Our governance recommendations build on these initiatives and seek to improve integration of federal programs with

state, tribal, and local efforts. Our other recommendations address persistent water problems that must be confronted in order to meet the challenge of 21st century western water management. The West is growing, our water resources are going to be called upon to work harder and harder, and we all must work together to achieve wise management of this most precious resource. Water defines the West, and our use of it will define the West of the 21st century.

## **Frequently Used Acronyms and Abbreviations**

BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BPA	Bonneville Power Administration
CAFOs	concentrated animal feedlot operations
cfs	cubic feet per second
Commission	Western Water Policy Review Advisory Commission
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
DWR	Department of Water Resources
EDF	Environmental Defense Fund
EIS	environmental impact statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FACA	Federal Advisory Committee Act
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
Interior	U.S. Department of the Interior
maf	million acre-feet
M&I	municipal and industrial
NAWQA	National Water Quality Assessment
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System Permit
NPR	National Performance Review
NPS	National Park Service
NRC	National Research Council
NRCS	Natural Resources Conservation Service
O&M	operation and maintenance
OMB	Office of Management and Budget
OM&R	operation, maintenance, and replacement
Reclamation	Bureau of Reclamation
SDWA	Safe Drinking Water Act
Service	U.S. Fish and Wildlife Service
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
Western	Western Area Power Administration
WGA	Western Governors' Association
WSWC	Western States Water Council

# Contents

	<i>Page</i>
Foreword . . . . .	i
Commission Membership . . . . .	iii
Staff to the Commission . . . . .	iv
Federal Agency Representatives and State Liaisons . . . . .	vi
Reports to the Commission . . . . .	vii
Presentations . . . . .	viii
Events and Public Meetings . . . . .	xi
Executive Summary . . . . .	xiii
Frequently Used Acronyms and Abbreviations . . . . .	xxxiii
 Chapter 1—Introduction . . . . .	 1-1
Water and the Changing West . . . . .	1-1
The Charge to the Commission . . . . .	1-2
Implementing the Commission's Charge . . . . .	1-4
The Commission's Investigations . . . . .	1-6
Public Testimony . . . . .	1-6
Research on the West Today . . . . .	1-6
River Basin Studies . . . . .	1-7
Agency Reports . . . . .	1-7
Organization of the Report . . . . .	1-8
 Chapter 2—The West Today and Tomorrow . . . . .	 2-1
Water Defines the West . . . . .	2-1
Topography and Climate . . . . .	2-1
Streamflows and the River Environment . . . . .	2-3
Western Water: A Working Resource . . . . .	2-5
Harnessing Water for Human Uses . . . . .	2-5
Major Water Uses . . . . .	2-6
Benefits of Federal Water Storage and Delivery Systems . . . . .	2-9
Environmental Consequences of Water Development . . . . .	2-12
The West in Transition . . . . .	2-14
Population Growth and Change . . . . .	2-14
Economic Growth and Change . . . . .	2-18
Changing Patterns of Agricultural and Urban Water Uses . . . . .	2-21
Agricultural . . . . .	2-24
Urban . . . . .	2-25
Native American Water Management . . . . .	2-28
Changing Land Uses . . . . .	2-28
Water Quality in the West . . . . .	2-30
Agricultural Return Flow as a Point Source . . . . .	2-31
The Effects of Irrigated Agriculture Drainage . . . . .	2-31
Alternatives to Reduce or Avoid Irrigation Return Flow Pollution . . . . .	2-32
The Changing Political, Fiscal, and Legal Landscape . . . . .	2-33

# Contents

	<i>Page</i>
Chapter 2—The West Today and Tomorrow (continued)	
The Changing Political, Fiscal and Legal Landscape (continued)	
Competing Legislative Mandates . . . . .	2-38
A Shrinking Pie . . . . .	2-38
The Rise of Nongovernmental Organization Litigation and Participation . . . . .	2-38
The Role of State Water Rightholders . . . . .	2-39
Conclusion . . . . .	2-39
Chapter 3—The Key Challenges Facing Western Water Managers . . . . .	3-1
Sustainable Water Management: The Overall Challenge for the Future . . . . .	3-1
Establishing a New Baseline . . . . .	3-2
Building Partnerships for Basin and Watershed Management . . . . .	3-3
More Players, Less Federal Influence . . . . .	3-3
The Sustainable Use of Existing Supplies . . . . .	3-6
Overallocation of Surface Water . . . . .	3-6
Groundwater Overdraft . . . . .	3-6
Increasing Supplies and Yield . . . . .	3-8
New Forms of Supply Augmentation . . . . .	3-8
Water Storage and Conveyance . . . . .	3-9
Storage and Conjunctive Use of Groundwater . . . . .	3-10
New Engineering Options: Desalinization and Weather Modification . . . . .	3-11
Water Importation . . . . .	3-12
Using Supplies More Efficiently . . . . .	3-12
Reclamation and Reuse . . . . .	3-12
Conservation . . . . .	3-13
More Accurate Reflection of the Value of Water . . . . .	3-14
Subsidies . . . . .	3-15
Confronting the Issues of Pricing . . . . .	3-17
Water Marketing . . . . .	3-22
Managing Shortages . . . . .	3-24
Modifying Operation of Federal Water Projects . . . . .	3-25
Decision-Relevant Science . . . . .	3-26
Hydropower . . . . .	3-28
Power Marketing Administrations (PMAs) . . . . .	3-32
Privatization of Federal Water Facilities . . . . .	3-35
Improving the Mechanisms of Governance . . . . .	3-36
The Changing Federal-State Relationship . . . . .	3-38
Agency Jurisdiction . . . . .	3-39
Collaborative Decisionmaking to Help Break the Gridlock . . . . .	3-40
Navigating the Road Ahead . . . . .	3-44
Meeting Obligations to Indian Nations and Tribes . . . . .	3-45
Water Rights Settlements . . . . .	3-46
Water Marketing . . . . .	3-46
Tribal Self-Management . . . . .	3-47
Indian Irrigation Projects . . . . .	3-47

# Contents

	<i>Page</i>
Chapter 3—The Key Challenges Facing Western Water Managers	
Meeting Obligations to Indian Nations and Tribes (continued)	
Basic Water Supply and Sanitation Facilities . . . . .	3-51
Environmental Protection and Restoration . . . . .	3-51
Restoring Aquatic Ecosystems . . . . .	3-51
Protecting Water Quality . . . . .	3-52
Flood Plain Management . . . . .	3-54
Protecting Productive Agricultural Communities . . . . .	3-57
Water Policy . . . . .	3-57
Community Influence . . . . .	3-58
Chapter 4—History of the Federal Water Programs . . . . .	4-1
Federal Constitutional Authority to Manage Water . . . . .	4-1
Legislative History: The Evolution of Federal Functions and Agencies . . . . .	4-2
Navigation Protection and Enhancement . . . . .	4-6
Flood Control . . . . .	4-6
Water for Agriculture . . . . .	4-7
Native Americans . . . . .	4-12
Hydropower . . . . .	4-14
Federal Conservation Programs . . . . .	4-14
Pollution Control and Environmental Regulation . . . . .	4-15
Fish and Wildlife . . . . .	4-16
Federal Watershed Management . . . . .	4-17
Forest Service . . . . .	4-17
Bureau of Land Management . . . . .	4-19
National Park Service . . . . .	4-20
A Brief History of Federal Water Resources Commissions . . . . .	4-21
The National Water Commission: Still a Benchmark . . . . .	4-23
Themes Common to Previous Water Commission Findings . . . . .	4-24
Chapter 5—How Federal and State Agencies Are Addressing the	
Challenges of Sustainable Water Management in the West . . . . .	5-1
The Many Players . . . . .	5-1
Private Interests . . . . .	5-1
Nongovernmental Groups and Special Interests . . . . .	5-2
Local Governments and Special Districts . . . . .	5-2
Tribal Governments . . . . .	5-3
State and Federal Governments . . . . .	5-3
International Agreements . . . . .	5-3
The Role of the States in Western Water Management . . . . .	5-4
Water Supply, Water Use, and Management of Droughts and Floods . . . . .	5-4
Administering the Prior Appropriation Doctrine . . . . .	5-4
Planning, Funding, and Developing Water Supplies . . . . .	5-5

# Contents

Page

Chapter 5—How Federal and State Agencies Are Addressing the Challenges of Sustainable Water Management in the West (continued)	
The Role of the States in Western Water Management (continued)	
Water Supply, Water Use, and Management of Droughts and Floods (continued)	
Increased Efficiency . . . . .	5-6
Modifying Existing Operations . . . . .	5-8
Groundwater Management . . . . .	5-8
Drought and Flood Management . . . . .	5-10
Environmental Protection . . . . .	5-10
Protecting the Public Interest . . . . .	5-10
Instream Flow Protection and Environmental Restoration . . . . .	5-11
Protecting Water Quality . . . . .	5-13
Groundwater Protection . . . . .	5-15
Land Use and Growth Planning . . . . .	5-17
Technical Assistance and Other Support Roles . . . . .	5-17
Improved Water Data and Information . . . . .	5-17
Assistance for Rural Communities . . . . .	5-18
Collaborative Partners and Problemsolver . . . . .	5-18
Future Directions for State Activities . . . . .	5-19
The Federal Programs and Activities Related to Western Water . . . . .	5-20
Environmental Protection and Tribal Rights Emphasis . . . . .	5-22
Federal Support for Water Development . . . . .	5-23
The Bureau of Reclamation . . . . .	5-23
The Army Corps of Engineers . . . . .	5-25
USDA Water Programs . . . . .	5-28
Water-Related Environmental Protection . . . . .	5-28
Environmental Protection Agency Programs Under the Clean Water Act . . . . .	5-28
USDA Conservation Programs . . . . .	5-29
Implementation of the Endangered Species Act . . . . .	5-31
The Army Corps of Engineers Civil Works Program . . . . .	5-33
The Bureau of Reclamation and Environmental Protection . . . . .	5-35
The Federal Energy Regulatory Commission and Hydropower Licenses . . . . .	5-38
Water for Indian Nations and Tribes . . . . .	5-39
Contemporary Federal Involvement in Western Water: Summary and Assessment . . . . .	5-40
Sustainability . . . . .	5-40
Environmental Issues . . . . .	5-40
Tribal Issues . . . . .	5-41
Changing Roles . . . . .	5-41
The Future Federal Role . . . . .	5-46
The Prospects for Federal and State Collaboration . . . . .	5-46
Chapter 6—Findings and Recommendations . . . . .	6-1
Principles of Water Management for the Future . . . . .	6-2
Ensure Sustainable Use of Resources . . . . .	6-2



# Contents

Page

## Chapter 6—Findings and Recommendations (continued)

### Principles of Water Management for the Future (continued)

Maintain National Goals and Standards . . . . .	6-2
Emphasize Local Implementation, Innovation, and Responsibility . . . . .	6-2
Provide Incentives . . . . .	6-3
Respect Existing Rights . . . . .	6-3
Promote Social Equity . . . . .	6-3
Organize Around Hydrologic Systems . . . . .	6-4
Ensure Measurable Objectives, Sound Science, Adaptive Management . . . . .	6-4
Employ Participatory Decisionmaking . . . . .	6-4
Provide Innovative Funding . . . . .	6-4

### Recommendations . . . . . 6-5

1. Integrating River Basin and Watershed Governance . . . . .	6-5
The Shaping Forces . . . . .	6-5
The Principal Goals . . . . .	6-5
Elements of Integrated Governance . . . . .	6-6
Coordination of the Federal Agencies . . . . .	6-7
Staffing and Budgeting for Local Consultation and Program Implementation . . . . .	6-9
2. Meeting Obligations to Tribes . . . . .	6-9
Fulfill Trust Responsibilities . . . . .	6-9
Resolve Indian Water Rights Claims . . . . .	6-10
Basin and Watershed Governance . . . . .	6-11
3. Resources Management and Restoration . . . . .	6-11
Protecting and Restoring the Environment, Including Aquatic Ecosystems and Water Quality . . . . .	6-11
Federal Agency Plans and Activities . . . . .	6-12
Establishing Environmental Restoration as a Priority . . . . .	6-13
Integrate Land and Water Management Agencies' Activities . . . . .	6-14
Support for Aquatic Science and Research . . . . .	6-15
Funding Mechanisms . . . . .	6-16
Water Quality . . . . .	6-17
Water Quality Standards . . . . .	6-17
Nonpoint Sources of Pollution . . . . .	6-18
Integrating Land and Water Quality Management . . . . .	6-19
Specific Sources of Water Quality Impairment . . . . .	6-19
Groundwater-Surface Water Linkage . . . . .	6-20
Water Use and Water Quality Linkage . . . . .	6-20
Irrigation Drainage and Retirement of Lands Unsuitable for Irrigation . . . . .	6-21
Integrated Watershed Solutions . . . . .	6-21
4. Management of Water and Water Facilities . . . . .	6-21
Modifying Operation of Existing Federal Projects to Better Address Current and Future Needs . . . . .	6-21
New Storage . . . . .	6-21
Water Reuse and Recycling . . . . .	6-22
Optimization of River Systems . . . . .	6-23

# Contents

*Page*

## Chapter 6—Findings and Recommendations (continued)

### Recommendations (continued)

#### 4. Management of Water and Water Facilities (continued)

##### Modifying Operation of Existing Federal Projects to Better Address

##### Current and Future Needs (continued)

Risk Sharing and Management ..... 6-23

Groundwater Management ..... 6-23

Drought Management ..... 6-23

Rural Domestic Water Supplies ..... 6-24

Promoting Efficiency and Flexibility of Water Use ..... 6-24

Water Conservation and Efficiency ..... 6-24

Pricing ..... 6-25

Operation of Dams and Water Delivery Systems ..... 6-25

Water Marketing and Transfers ..... 6-26

Enforcement of Reclamation Law ..... 6-28

Flood Plain Management ..... 6-29

Need for Overarching Flood Management Policy ..... 6-29

Recommendations ..... 6-29

Maintaining the Water Infrastructure ..... 6-32

5. Protecting Productive Agricultural Communities ..... 6-34

##### Reducing Costs of Environmental Compliance, and

Increasing Certainty of Water Use for Water Users ..... 6-36

6. Improving Decisionmaking, Reducing Conflict ..... 6-37

Coordinating Federal Water Management ..... 6-37

Coordination of Federal Water Policy ..... 6-38

Program and Budget Coordination ..... 6-39

The Federal Role in Research and Data Collection ..... 6-39

Using Good Science ..... 6-39

Adaptive Management and Monitoring ..... 6-40

Monitoring ..... 6-41

Water Research ..... 6-41

National Water Data ..... 6-42

Data Sharing ..... 6-43

Public Participation ..... 6-43

Federal Advisory Committee Act ..... 6-43

Alternative Dispute Resolution ..... 6-44

Revising the Principles and Guidelines ..... 6-45

Bibliography ..... Bib-1

# Contents

## Appendices

### *Appendix*

A	Biographies of Commission Members . . . . .	A-1
B	Commission Member Comments on Final Report . . . . .	B-1
C	Congressional Research Service Report to the Commission . . . . .	C-1

## Sidebars

### *Page*

The Congressional Charge to the Commission . . . . .	1-3
Precipitation Variability: Nemesis of Western Water Managers . . . . .	2-4
Groundwater Resources in the Western United States—Sustainability and Trends . . . . .	2-7
The Federal Water Agencies . . . . .	2-11
Lake Tahoe: Can We Keep From Loving It to Death? . . . . .	2-16
Coordinating Federal Programs . . . . .	2-34
The Deschutes River Basin Resources Conservancy . . . . .	3-5
The Henry's Fork Watershed . . . . .	3-7
Arizona House Bill 2494 . . . . .	3-18
Improving Water Use Efficiency and Fish Passage . . . . .	3-21
Water Transfers: The Large and the Small . . . . .	3-23
AgriMet—An Automated Weather Monitoring System for Irrigation Water Management . . . . .	3-27
The Artificial Glen Canyon Flood of 1996 . . . . .	3-29
Use of Adaptive Management by Federal Resource Agencies . . . . .	3-30
The Shasta Dam Temperature Control Device: A New Method for Improving River Conditions for Salmon . . . . .	3-34
More Efficient Funding of Federal Powerplant Repairs . . . . .	3-37
The CALFED Process: A Model for Resolving Complex Water Disputes . . . . .	3-42
Tribal Water Rights Settlements . . . . .	3-48
Dam Removal: A New Option . . . . .	3-53
"We'd Like to Make One Thing Perfectly Clear" . . . . .	3-56
New Approaches to Flood Management . . . . .	3-59
High Stakes! Preserving Colorado's Great Outdoors . . . . .	3-62
Public Trust Doctrine—Its Role in Protecting Water Resources . . . . .	3-63
Major Federal Laws and Actions Affecting Western Water Resources . . . . .	4-4
Repayment of Reclamation Water Projects . . . . .	4-8
Federal Reserved Water Rights at Zion National Park . . . . .	4-13
General Stream Adjudication . . . . .	5-7
California State Drought Water Bank . . . . .	5-9
The TMDL Dilemma . . . . .	5-12
State of Oregon Growth Management Program . . . . .	5-16

# Contents

## Sidebars (continued)

	<i>Page</i>
Yakima River Basin Water Enhancement Project .....	5-24
EPA's Watershed Protection Approach .....	5-26
Chalk Creek Watershed: Reducing Erosion and Sedimentation of Streams .....	5-30
Water Conservation in Agriculture .....	5-32
Water for Wildlife Refuges .....	5-34
National Fish and Wildlife Foundation .....	5-36
HCPs, "Safe Harbor," "No Surprises": New Approaches to Protecting Threatened and Endangered Species .....	5-43
The Platte River Agreement: Historic Federal/Three-State Initiative .....	5-48
Wherever Land Divides Us, Water Unites Us .....	6-8

## Tables

<i>Table</i>	<i>Page</i>
2-1 Hydroelectric capacity in the West by water resource region: 1992 .....	2-10
2-2 Ten fastest growing cities in the country, 1990-94 .....	2-14
2-3 Ten fastest growing states in the nation, 1990-94 .....	2-15
2-4 Projected growth in western states, 1995-2000 .....	2-17
2-5 Dollar earnings by firms organized into 20 industrial sectors in 1993 .....	2-19
2-6 Water-related outlays in the President's February 1997 budget by agency .....	2-36
5-1 1997 discretionary funding by state budget authority .....	5-21

## Figures

<i>Figure</i>	<i>Page</i>
2-1 United States precipitation, in centimeters .....	2-2
2-2 The ratio of reservoir storage to annual water supply in parts of North America .....	follows page 2-40
2-3 Western states irrigation water sources, 1990 .....	2-8
2-4 Recent population change in the western states .....	follows page 2-40
2-5 Recent patterns of demographic movement in the West .....	follows page 2-40
2-6 Crop exports and estimated share from western irrigation .....	2-20
2-7 Agricultural exports, 1996 and projected years .....	2-20
2-8 Comparison of contribution to gross national product and total economic use of water .....	follows page 2-40
2-9 Source, use, and disposition of freshwater (179 maf) in 1990 in the western United States ...	2-23

# Contents

## Figures (continued)

<i>Figure</i>	<i>Page</i>
2-10 Freshwater withdrawals by water-use category in the western states, 1960 and 1990 . . . . .	2-23
2-11 Crop sales and irrigated cropland in the West by crop, 1992 . . . . .	2-26
2-12 Western irrigated water applications by crop, 1994, based on data from 17 states . . . . .	2-26
2-13 Percent change in developed land area, 1982-1992 . . . . .	follows page 2-40